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| IN RE APPLICATION OF | : | |
| MOTOKI NUMATA, ET AL. | : | ART UNIT: 1722 |
| SERIAL NO: 10/713,013 | : | |
| FILED: NOVEMBER 17, 2003 | : | EXAMINER: R. KUNEMUND |
| FOR: PROCESS OF PRODUCING COMPOUNDS | : | |

# APPEAL BRIEF

COMMISSIONER FOR PATENTS
ALEXANDRIA, VIRGINIA 22313

SIR:

## Table of Contents

(i) Real Party in Interest

Mitsubishi Chemical Corporation and Tomoe Engineering Co., Ltd. are the real parties in interest.

(ii) Related Appeals or Interferences

The Appellants are unaware of any related appeals or interferences that would directly affect, be directly affected by, or have a bearing on the Board's decision in this appeal.

(iii) Status of the Claims

Claims 25-49 are on Appeal. Claim 25 is the only independent claim on Appeal. Claims 1-24 have been cancelled.

The Claims Appendix below provides a clean copy of the claims on appeal appearing the Amendment filed March 22, 2007.

(iv) Status of the Amendment

The Amendment filed on March 22, 2007 will be entered for purposes of Appeal (see the Advisory Action dated April 12, 2007).

(v) Summary of the Claimed Subject Matter

Independent Claim 25 is directed to a process for making a compound that includes at least the following steps: (A) a reaction step that forms a slurry containing a compound, (B) a separation step that converts the slurry into a cake containing the compound, and (C) a step for drying the cake containing the compound by moving it into a compound recovery zone having a pressure and temperature lower than those in the separation step, thereby evaporating the cake-attached liquid by internal energy (specification, page 4, lines 5 *ff.*). Particular physical parameters material to drying step (C) are recited by claims 27-29 or particular reactants or products in dependent claim 34.

The terms in Claim 25 find specific support in the original claims and specification as indicated in **embolded** text below:

Claim 25 A process for producing a compound comprising **(claim 1, preamble)**:

(A) introducing a substrate and a reaction medium into a reactor at a pressure higher than atmospheric pressure and at a temperature at least equal to the boiling point at atmospheric pressure of the reaction medium for a time and under conditions suitable to form said compound in the form of a slurry containing the compound and the reaction medium **(claim 1, step A)**;

(B) separating at least some of the reaction medium from said slurry at a pressure higher than atmospheric pressure and at a temperature at least equal to the boiling point at atmospheric pressure of the reaction medium to obtain a cake having a weight ratio of a cake-attached liquid of not more than 50% based on the solids content **(claim 1, step B)**; and

(C) drying the resulting cake by moving it into a compound recovery zone under conditions in which the internal energy released by the movement of the compound into the compound recovery zone evaporates the cake-attached liquid, said conditions comprising

moving the compound into a compound recovery zone having a pressure lower than the pressure in (B) **(claim 1, step C)**;

wherein in the drying step (C), a weight ratio of the cake-attached liquid is not more than 10 % based on the solids content **(claim 15; page 26, line 2)**.

Support for dependent claims 27-29 and 34, is found as indicated below.

Claim 27: The process of producing a compound according to claim 25, wherein in the separation step (B), the cake is washed with a washing liquid having an evaporation latent heat at the boiling point at atmospheric pressure of not more than 300 kcal/kg in a state in which the pressure is kept at higher than atmospheric pressure, and the temperature is kept at the boiling point at atmospheric pressure of the reaction medium or higher **(claim 2, page 19, 2nd paragraph)**.

Claim 28: The process of producing a compound according to claim 25, wherein the reaction medium has an evaporation latent heat at the boiling point at atmospheric pressure of not more than 300 kcal/kg **(claim 3; page 9, line 18)**.

Claim 29: The process of producing a compound according to claim 25, wherein in the separation step (B), the cake is washed with a washing liquid having a temperature in the range of the boiling point at atmospheric pressure of the washing liquid or higher but not higher than (TB1 + 100°C) (wherein TB1 stands for the temperature (°C) of an unwashed cake) **(claim 4, page 18, first paragraph)**.

Claim 34: The process of producing a compound according to claim 32, wherein in (A), p-xylene is subjected to liquid phase oxidation with molecular oxygen to obtain terephthalic acid **(claim 9; page 31, lines 4-7, 2nd to last line)**.

(vi) Grounds of Rejection to be Reviewed on Appeal

A. Whether Claims 25, 26, and 31-38 are unpatentable under 35 U.S.C. 103(a) over Turner et al., U.S. Patent No. 6,307,099, in view of Beard et al., WO 00/71226.

B. Whether Claims 27-30 and 39-49 are unpatentable under 35 U.S.C. 103(a) over Turner et al., U.S. Patent No. 6,307,099, in view of Beard et al., WO 00/71226.

(vii) Arguments

Issue A

Claims 25, 26, and 31-38 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Turner et al., U.S. Patent No. 6,307,099, in view of Beard et al., WO 00/71226.

The process of independent claim 25 provides a significantly dry product (no more than 10% cake attached liquids) by economically using reaction heat to dry the product moved in to a lower pressure recovery zone.

Turner is directed to a process for making terephthalic acid (see title, abstract) which is also the product of the process in dependent claim 34. However, Turner does not disclose or suggest step (C) (drying the cake using its own internal energy), see independent claim 25. The final Official Action (page 3, lines 2-3) agrees that the Turner process does not include this step. However, it is asserted that it would have been obvious to incorporate step (C) into the method of Turner based on Beard et al. which is cited as teaching drying at a low pressure in order to vaporize liquid and speed drying. However, Beard does not disclose that a depressurizing step can significantly dry a product to the degree obtained by the invention.

Rather, both Turner and Beard disclose subsequent product drying using conventional drying steps and do not suggest drying the product to a degree where it has not more than 10% attached liquids using its "internal energy released by the movement of the compound" as required by the invention. Col. 20, lines 29-31 of Turner indicate "The filter cake is removed from the filter cloth and supplied to a drier 237 to produce dried terephthalic acid crystals". Turner contemplates a conventional drying step after a solid-liquid separation and does not suggest step (C) of the invention.

The claimed process does not require the conventional dryers used by Turner, e.g., an apparatus such as a rotary steam tube drier or a fluidized bed drier to achieve the degree of dryness required by claim 25 (Fig. 1, col. 13, lines 54 *ff.* of Turner). A drier is unnecessary in

the process of the invention. The energy used by conventional dryers is reduced and a simple process is provided--see page 3, 3rd full paragraph of the specification which discloses that an "object of the invention is to reduce the use of energy in the drying step by utilizing internal energy that the slurry after reaction has, and. . .to greatly reduce energy to be used by drying the cake only by internal energy". Unlike the Turner process, the claimed process does not require a conventional drying step after recovery step (C) to obtain a product having a high degree of dryness. Omission of an element (step) with retention of the element's function is an indicia of non-obviousness, MPEP 2144.04 (II)(B), *In re Edge*, 149 USPQ 556 (CCPA 1966). Here, the omitted element is the conventional drying steps required to obtain a product having no more than 10% cake attached liquids.

Beard, also does not contemplate using a depressurization step in conjunction with internal heat of the product to dry the product so that it has no more than 10% cake attached liquids. The Beard abstract, last line, discloses that "Subsequently, the depressurized solid phase material can be conveyed to other equipment for drying or other processing" and lines 5-6 from the bottom of page 5 contemplate "(g) conveying the depressurized solid phase material to a **dryer** (emphasis added)".

While Beard, page 4, first paragraph, discloses "Advantageously, the rapid depressurizing can cause 'flashing' of the solid phase material, which removes residual liquid, gas and volatile substances", the Beard processes contemplate subsequent drying of the material and do not disclose or suggest using rapid depressurization to obtain a produce with the high degree of dryness recited by independent claim 25. Further, even though page 4 of Beard refers to "flashing" of the solid phase material, it does not suggest drying step (C) of the invention which requires moving the separated solid into a compound recovery zone under conditions in which the internal energy released by the movement of the compound into the compound recovery zone evaporates the cake-attached liquid.

Moreover, Turner and Beard provide no reasonable expectation of success for obtaining a product in which "a weight ratio of the cake-attached liquid is not more than 10% based on the solids content" as required by the last phrase in independent claim 25. For example, there is no suggestion to select a reaction medium such as that required by claim 28 or to "optimize" other parameters associated with this step. Turner cannot provide a reasonable expectation of success because it does not even contemplate a depressurization step. Beard contemplates conventional drying, and does not recognize the performing step (C) of the invention would produce a highly dry product.

While the present claims do not exclude subsequent processing or drying steps, the process as claimed provides a significant improvement over the prior art processes which did not recognize that step (C) could provide such a high degree of dryness (no more than 10% cake attached liquids), nor provide any motivation for optimizing process conditions to obtain this higher degree of dryness.

This increased degree of dryness provided by the claimed process is industrially and commercially significant since it reduces the energy cost conventionally needed to dry the cake and provides a simpler chemical process, see e.g., the specification, page 3, third paragraph.

The present inventors have obtained a greater than expected dryness through a depressurization step that provides a product that has no more than 10% cake attached liquids. Tables 1 and 2 compare the liquid content of cake before and after flash separation. In the processes of Examples 1-3, no new energy is used in the drying step other than the temperature and pressure generated in the reaction step (specification, page 45, lines 11-13). The resulting dried products had liquid contents ranging from 0.1 to 5.7%, well below the 10% limit in independent claim 25. In comparison, the product cake in Comparative Example 1 which does not use flash drying (like the Turner process) required 36,000 kcal per

ton to reduce liquid content from 15% to 0.1% (specification, page 40, last paragraph. While Beard refers to rapid depressurization and flashing, and illustrates a pressure filtration device, but it provides no examples of a process performed with such a device. It is impossible to compare the claimed process with the vague and generic processes described by Beard due to its lack of exemplification. Thus, this document is merely an invitation to experiment with depressurization or other drying means to help dry a product, but provides no expectation of success for the highly dry product obtained by the inventors.

"A greater than expected result is an evidentiary factor pertinent to the legal conclusion of obviousness. . .", *In re Corkhill*, 226 U.S.P.Q. 1005 (Fed. Cir. 1985); "Evidence that a compound is unexpectedly superior in one of a spectrum of common properties. . .can be enough to rebut a *prima facie* case of obviousness", *In re Chupp*, 2 U.S.P.Q. 2d 1437, 1439 (Fed. Cir. 1987). In the present situation, the claimed process produces a greater than expected degree of dryness and a dryer product without resorting to other energy intensive drying steps disclosed by Turner and Beard. Therefore, the Appellants respectfully request that this rejection be reversed.

Issue B

Claims 27-30 and 39-49 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Turner et al., U.S. Patent No. 6,307,099, in view of Beard et al., WO 00/71226. The Appellants respectfully request that this rejection be reversed for the reasons discussed above. The Official Action indicates that it would have been obvious to optimize the process parameters disclosed by these references to produce a purer product at a higher speed. However, the cited prior art does not describe many of the parameters required by these claims (e.g., the washing steps of claim 27 or 29 or the reaction medium parameters of

claim 28), nor indicate which reaction parameters to optimize (i.e., which parameters are "results effective").

> A particular parameter must first be recognized as a result-effective variable, i.e., a variable which achieves a recognized result, before the determination of the optimum or workable ranges of said variable might be characterized as routine experimentation. *In re Antonie* 195 USPQ 6, (CCPA 1977) (MPEP 2144.05(b))

As discussed above, neither Turner, nor Beard suggest processes which omit conventional drying steps, nor do they provide a reasonable expectation of success for obtaining a product with no more than 10% cake attached liquids using depressurization as required by step (C). Therefore, one with ordinary skill in the art would not have had a reasonable expectation of success for practicing the present invention based on the teachings of these documents. For these reasons, the Appellants respectfully request that this rejection be reversed.

## RELIEF REQUESTED

The Appellants respectfully request reversal of the grounds of rejection above and the allowance of this application.

Respectfully submitted,

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## (viii) Claims Appendix

Claims 1-24 (Cancelled):

Claim 25 (Previously Presented): A process for producing a compound comprising:

(A) introducing a substrate and a reaction medium into a reactor at a pressure higher than atmospheric pressure and at a temperature at least equal to the boiling point at atmospheric pressure of the reaction medium for a time and under conditions suitable to form said compound in the form of a slurry containing the compound and the reaction medium;

(B) separating at least some of the reaction medium from said slurry at a pressure higher than atmospheric pressure and at a temperature at least equal to the boiling point at atmospheric pressure of the reaction medium to obtain a cake having a weight ratio of a cake-attached liquid of not more than 50% based on the solids content; and

(C) drying the resulting cake by moving it into a compound recovery zone under conditions in which the internal energy released by the movement of the compound into the compound recovery zone evaporates the cake-attached liquid, said conditions comprising moving the compound into a compound recovery zone having a pressure lower than the pressure in (B);

wherein in the drying step (C), a weight ratio of the cake-attached liquid is not more than 10 % based on the solids content.

Claim 26 (Previously Presented) The process according to claim 25, wherein in the drying step (C), the resulting cake is moved into a compound recovery zone having a pressure lower than the pressure in (B) and a temperature lower than the temperature in (B).

Claim 27 (Previously Presented): The process of producing a compound according to claim 25, wherein in the separation step (B), the cake is washed with a washing liquid having

an evaporation latent heat at the boiling point at atmospheric pressure of not more than 300 kcal/kg in a state in which the pressure is kept at higher than atmospheric pressure, and the temperature is kept at the boiling point at atmospheric pressure of the reaction medium or higher.

Claim 28 (Previously presented): The process of producing a compound according to claim 25, wherein the reaction medium has an evaporation latent heat at the boiling point at atmospheric pressure of not more than 300 kcal/kg.

Claim 29 (Previously Presented): The process of producing a compound according to claim 25, wherein in the separation step (B), the cake is washed with a washing liquid having a temperature in the range of the boiling point at atmospheric pressure of the washing liquid or higher but not higher than (TB1 + 100°C) (wherein TB1 stands for the temperature (°C) of an unwashed cake).

Claim 30 (Previously Presented): The process of producing a compound according to claim 25, wherein in the separation step (B), the cake is washed with a washing liquid in an amount of from 0.03 to 5.0 times based on the weight of the solids content in the cake.

Claim 31 (Previously Presented): The process of producing a compound according to claim 25, wherein the compound to be formed in the reaction step (A) is an aromatic carboxylic acid.

Claim 32 (Previously Presented): The process of producing a compound according to claim 31, wherein the aromatic carboxylic acid is terephthalic acid.

Claim 33 (Previously Presented): The process of producing a compound according to claim 31, wherein in the reaction step (A), an alkyl group-substituted aromatic compound is subjected to liquid phase oxidation with molecular oxygen to obtain the aromatic carboxylic acid.

Claim 34 (Previously Presented): The process of producing a compound according to claim 32, wherein in (A), p-xylene is subjected to liquid phase oxidation with molecular oxygen to obtain terephthalic acid.

Claim 35 (Previously Presented): The process of producing a compound according to claim 25, wherein (A) is carried out at a temperature in the range of from 50°C to 350°C.

Claim 36 (Previously Presented): The process of producing a compound according to claim 25, wherein (A) is carried out under a pressure in the range of exceeding atmospheric pressure but not higher than 20 MPa.

Claim 37 (Previously Presented): The process of producing a compound according to claim 25, wherein in the drying step (C), a difference between the temperature of the cake in (B) and the temperature of the cake discharged into the compound recovery zone is from 5°C to 250°C.

Claim 38 (Previously Presented): The process of producing a compound according to claim 25, wherein in the drying step (C), a difference between the pressure in (B) and the pressure in the compound recovery zone is from 0.01 MPa to 22 MPa.

Claim 39 (Previously Presented): The process of producing a compound according to claim 25, wherein in the drying step (C), the compound to be discharged has a median diameter of from 40 μm to 300 μm.

Claim 40 (Previously Presented): The process of producing a compound according to claim 25, wherein in the drying step (C), a weight ratio of the cake-attached liquid is not more than 10 % based on the solids content.

Claim 41 (Previously Presented): The process of producing a compound according to claim 25, wherein in the drying step (C), a weight ratio of the cake-attached liquid is reduced by 3% or more based on the solids content.

Claim 42 (Previously Presented): The process of producing a compound according to claim 25, wherein in the drying step (C), an intermediate chamber is provided between a separation device used for (B) and the compound recovery zone.

Claim 43 (Previously Presented): The process of producing a compound according to claim 42, wherein in the drying step (C), a dry gas is introduced into the intermediate chamber and/or the compound recovery zone.

Claim 44 (Previously Presented): The process of producing a compound according to claim 25, wherein in the drying step (C), the pressure in the compound recovery zone is atmospheric pressure.

Claim 45 (Previously Presented): The process of producing a compound according to claim 25, wherein a pressure drying device provided with a discharge valve is used for drying step (C).

Claim 46 (Previously Presented): The process of producing a compound according to claim 45, wherein a contact portion between a valve body and a valve seat of the discharge valve is linear and its shape is circular.

Claim 47 (Previously Presented): The process of producing a compound according to claim 45, wherein in the drying step (C), the discharge valve is intermittently opened, and an opening time is from 0.01 seconds to 1 second.

Claim 48 (Previously Presented): The process of producing a compound according to claim 25, wherein an intermediate processing step (D) for carrying out crystallization or dissolution of the compound is provided between the reaction step (A) and the separation step (B).

Claim 49 (Previously Presented): The process of producing a compound according to claim 25, wherein in the reaction step (A), the formed compound is obtained as a solid.

## (ix) Evidence Appendix

(none)

## (x) Related Proceedings Appendix

(none)